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Juvenile Salmon Survival Studies in the North Delta

Abstract: We developed a multistate mark-recapture model to estimate 1) survival of juvenile salmon using different migration routes to negotiate the Sacramento-San Joaquin River Delta, and 2) the probability of fish using each route. Since these parameters determine population-level survival, simultaneous estimation of both allowed us to quantify the relative contribution of each migration route to population-level survival. We applied this model to four years of acoustic telemetry data (2007-2010) with releases made when the Delta Cross Channel gates were both open and closed. We identified consistent patterns in survival among migration routes, but substantial variation in survival among releases and years. Specifically, releases in 2008 exhibited lower survival than other years. Despite considerable variation among releases, survival for routes leading to the interior Delta was always lower than for Sacramento River. Fish that migrated through Sutter and Steamboat sloughs had survival probabilities that ranged between that of the Sacramento River and the interior Delta. Because of route-specific differences in survival, the fraction of fish using each migration route will affect population-level survival. The fraction of fish entering each route was generally related to the fraction of discharge, but large deviations from this expected relation suggested other factors also influenced migration routing. We discuss how survival within migration routes interacts with movement among routes to influence population survival.

Statement of Relevance: Water management actions affect both quantity and distribution of river flow among the Delta's complex network of channels. Understanding the response of juvenile salmon to water flow and distribution is critical for quantifying the effect of water management actions on endangered juvenile salmonids.